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EXAMINER	
WEST, JEFFREY R	
ART UNIT	**PAPER NUMBER**
2857	

DATE MAILED: 10/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/921,293	CLARKE ET AL.
	Examiner	**Art Unit**
	Jeffrey R. West	2857

UAY

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 July 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8,10-30,32 and 33* is/are rejected.

7)☒ Claim(s) *9 and 31* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☒ The proposed drawing correction filed on *11 July 2003* is: a)☒ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. The examiner requests a copy of the relevant pages of the following reference, listed on page 40 of the specification, as it is considered pertinent to the examination of the application:

Kline et al., "Describing Uncertainties in Single Sample Experiments." Mech. Eng.

Specification

2. The disclosure is objected to because of the following informalities:

The specification contains the confusing statement, "Further, if the lock indicator remains OFF for the predetermined wait-for-recovery amount of time." on page 44, lines 23-24.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 3-5, 8 and 13 are rejected under 35 U.S.C. 103(a) as being

unpatentable over U.S. Patent No. 4,463,612 to Thompson in view of U.S. Patent No. 6,466,069 to Rozenblit et al. and further in view of U.S. Patent No. 3,751,979 to Ims.

Thompson discloses an electronic circuit using digital techniques for vortex shedding flowmeter signal processing comprising a vortex flow sensor (i.e. process variable transmitter) that produces a signal over a line, which varies with the vortex shedding frequency, to a preamplifier, and then over an A.C. coupling to a phase detector (column 2, lines 63-66). Thompson discloses a phase lock loop (column 3, lines 1-4) comprising a phase detector that receives the input signal and produces an output signal to a low-pass loop filter that outputs a filtered signal to a voltage controlled oscillator that feeds-back a locking oscillator signal to the phase detector (Figure 1). Thompson also discloses including the components of the system on a single low-power digital signal processor chip used for use in a software process (column 3, lines 39-43 and 61-62). Thompson discloses including an amplitude detector (i.e. drop out detector) that senses the amplitude of the input signal and generates a low flow signal when it is below a predetermined level (column 2, lines 13-19).

Thompson, however, only discloses using one phase locked loop and therefore also fails to disclose a switching means for selectively connecting first or second phase lock loops based on bandwidth characteristics.

Rozenblit teaches a fast settling charge pump biasing circuit that varies the bias when a phase lock loop changes frequency to improve the settling time of the phase

locked loop (abstract). Rozenblit specifies that the phase locked loop include a phase detector, loop filter, and voltage controlled oscillator, wherein the voltage controlled oscillator feeds back the oscillator signal to the phase detector (Figure 1). Rozenblit also teaches changing the locking frequency of the phase locked loop between a narrow bandwidth, small natural frequency, to provide greater immunity to noise, and a larger bandwidth, large natural frequency, to provide faster locking (column 7, line 54 to column 8, line 1). Rozenblit also teaches performing this frequency change based upon a determination that the phase locked loop is locked (column 4, lines 28-32).

Ims teaches a flow speed measurement system (column 1, lines 29-30) including two separate phase locked loops (column 16, lines 6-8) and a switch operable to switch between a first output of the first phase locked loop and a second output of the second phase locked loop (column 6, lines 26-29 and Figure 8).

It would have been obvious to one having ordinary skill in the art to modify the invention of Thompson to include selecting between different bandwidth characteristics of a phase locked loop, as taught by Rozenblit, because Thompson teaches that vortex sensors are known to produce noise or fluctuating signals (column 1, lines 21-28) and Rozenblit suggests that the combination would have allowed optimization of the phase locked loop speed while reducing/providing immunity to noise and therefore providing an overall stable phase locked loop (column 8, line 1-19).

It would have been obvious to one having ordinary skill in the art to modify the invention of Thompson and Rozenblit to include two phase locked loops rather than modifying one phase locked loop, as taught by Ims, because the combination would have provided a faster, simpler, method for switching between two different frequency phase locked loop responses and, as suggested by Ims, provided increased efficiency since the two loop would be continuously driven in desired operation (column 16, lines 54-56).

Although not specifically disclosed, it would have been obvious to one having ordinary skill in the art to allow the user to have more control over the sensing process by specifying that the predetermined low-flow amplitude limit be user-controlled.

5. Claims 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thompson in view of Rozenblit and Ims and further in view of U.S. Patent No. 5,576,497 to Vignos et al.

As noted above, Thompson in combination with Rozenblit and Ims teaches all of the features of the claimed invention except for specifying that the vortex flow sensor sense pressure variations due to vortex shedding of a fluid in a passage, converting the pressure variations to a sinusoidal signal, or pre-filtering the signal processing.

Vignos teaches adaptive filtering for a vortex flowmeter including a well known vortex sensor that produces an analog sinusoidal signal representative of the alternating differential pressure various to calculate fluid flow or velocity (column 2,

lines 44-49). Vignos also teaches an initial signal conditioner which filters the signal before subsequent processing occurs (column 2, lines 49-57). Vignos also teaches that the pre-filtering is switched on and off based upon high or low flow signals obtained in accordance with filter cut-off frequencies (column 2, lines 58-67 and column 6, lines 25-37).

It would have been obvious to one having ordinary skill in the art to modify the invention of Thompson, Rozenblit, and Ims to include specifying that the vortex flow sensor sense pressure variations due to vortex shedding of a fluid in a passage and converting the pressure variations to a sinusoidal signal, as taught by Vignos, because Thompson in combination with Rozenblit and Ims teaches the processing method, not the specifics of the sensor itself, and Vignos teaches the well known features of a vortex sensor.

Further, It would have been obvious to one having ordinary skill in the art to modify the invention of Thompson, Rozenblit, and Ims to include pre-filtering the signal before processing, as taught by Vignos, because, as suggested by Vignos, the combination would have provided a method for conditioning the signal to obtain a desired bandwidth around the vortex frequency and therefore preserved a high signal-to-noise ratio which produces a more accurate flow measurement over a wider variety of flow conditions (column 2, lines 58-67)

6. Claims 2, 21, 22, 24, and 29 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Thompson in view of Rozenblit and Ims and further in view of U.S. Patent No. 6,236,278 to Olgaard.

As noted above, Thompson in combination with Rozenblit and Ims teaches all the features of the claimed invention except for including a lock indicator signal indicating when the phase locked loop is locked

Olgaard teaches an apparatus and method for a fast locking phase locked loop comprising a control circuit that, in accordance with a lock signal, and reference and feedback signal frequency divider circuits, transitions between first and second circuit operation modes when, the PLL lock signal indicates that the PLL has transitioned between unlocked and phase locked states of operation (column 5, lines 41-48).

It would have been obvious to one having ordinary skill in the art to modify the invention of Thompson, Rozenblit, and Ims to include lock indicator signal indicating when the phase locked loop is locked, as taught by Olgaard, because Olgaard suggest that by providing a lock signal in a dual mode PLL circuit (column 5, lines 55-58), the combination would have quickly indicated that the PLL is locked and therefore allowed sooner processing, by implementing processing as soon as the signal is received (column 1, lines 20-26 and column 6, lines 11-22).

Further, since the invention of Thompson, Rozenblit, and Ims teaches switching between the first and second phase locked loops when it is determined that the loop is locked and Olgaard teaches generating a lock indicator signal when the loop is

locked, the combination would have provided a method for switching between the two phase locked loops based upon the occurrence of a lock indicator signal.

With respect to claim 24, since the invention of Thompson, Rozenblit, Ims, and Olgaard teaches switching to a first PLL when it is determined that the first PLL is locked, this method is considered to be functionally equivalent to the non-critical step of switching from a second PLL to a first PLL when it is determine that the second PLL is unlocked.

With respect to claim 29, it is considered to be well-known in the art, and admitted as prior art by Applicant, that low flow conditions produce a small output amplitude in a flow sensor (See instant specification, page 1, line 23 to page 2, line 4 and U.S. Patent No. 5,493,915 to Lew et al. column 5, lines 9-18). Therefore, as noted above, since the combination of Thompson, Rozenblit, and Ims teaches switching between a second phase locked loop with a narrow bandwidth, small natural frequency, to provide greater immunity to noise, and a first phase locked loop with a larger bandwidth, large natural frequency, to provide faster locking, it would have been obvious to one having ordinary skill in the art to switch to the second phase locked loop when a low-flow condition occurs because the combination would have provided a more accurate result by using the PLL that is less likely to allow noise to interfere with the small amplitude signal.

7. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable

over Thompson in view of Rozenblit and Ims and further in view of U.S. Patent No. 6,298,100 to Bouillet.

As noted above, Thompson in combination with Rozenblit and Ims teaches all the features of the claimed invention except for specifying that the phase detectors comprise a heterodyning module and a Hilbert transformer.

Bouillet teaches a phase error estimation method for a demodulator comprising a phase locked loop with a pilot component as a reference and a conventional phase detector for phase acquisition, all part of a phase control loop (column 3, lines 13-17). Bouillet also teaches including a Hilbert filter for receiving the pilot signal, transforming the signal into in-phase and quadrature components, and applying the transformed components to the phase control loop (column 3, lines 31-46). Bouillet also teaches heterodyning the reference pilot with the carrier in the main path of the phase locked loop (column 4, lines 15-30).

It would have been obvious to one having ordinary skill in the art to modify the invention of Thompson, Rozenblit, and Ims to include specifying that the phase detectors comprise a heterodyning module and a Hilbert transformer, as taught by Bouillet, because, as suggested by Bouillet, the combination would have reduced distortion errors by heterodyning the received spectrum of the phase locked loop down to a baseband (column 4, lines 15-22) as well as produced a phase control signal by correlating received sync values with a Hilbert transform of a reference sync value (column 3, lines 61-65).

8. Claims 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thompson in view of Rozenblit and Ims and further in view of U.S. Patent No. 5,570,300 to Henry et al.

As noted above, Thompson in combination with Rozenblit and Ims teaches all the features of the claimed invention except for specifying that the transmitter include a module for generating uncertainty parameters including a status variable.

Henry teaches self-validating sensors, using software (column 14, lines 40-41), that include a transducer for generating a data signal related to the value of a variable and a transmitter for receiving the data signal and generating output signals, wherein the transmitter generates a first output signal related to the value of the variable and a second output based on a dynamic uncertainty analysis of the first output signal (abstract). Henry also teaches that the uncertainty parameters include a measurement status variable (column 2, lines 17-20) indicating quality (column 7, lines 60-63).

It would have been obvious to one having ordinary skill in the art to modify the invention of Thompson, Rozenblit, and Ims to include specifying that the transmitter include a module for generating uncertainty parameters including a status variable, as taught by Henry, because, as suggested by Henry, the combination would have allowed the user of the sensors to obtain an accuracy measurement of the sensor data since sensors do not perfectly represent the value of a process variable obtained, and often includes effects, such as faults or distortion, resulting from the sensor itself (column 1, lines 20-26).

9. Claims 25-27, 30, 32, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thompson in view of Rozenblit, Ims, and Olgaard and further in view of U.S. Patent No. 5,570,300 to Henry et al.

As noted above, Thompson in combination with Rozenblit, Ims, and Olgaard teaches all the features of the claimed invention except for specifying that the transmitter include a module for generating uncertainty parameters including a status variable.

Henry teaches self-validating sensors, using software (column 14, lines 40-41), that include a transducer for generating a data signal related to the value of a variable and a transmitter for receiving the data signal and generating output signals, wherein the transmitter generates a first output signal related to the value of the variable and a second output based on a dynamic uncertainty analysis of the first output signal (abstract) and self-validation that provides a best estimate of the value of a parameter being monitored based on all information available to the sensor (column 2, lines 10-14). Henry also teaches that the uncertainty parameters include a measurement status variable (column 2, lines 17-20) indicating quality (column 7, lines 60-63).

It would have been obvious to one having ordinary skill in the art to modify the invention of Thompson, Rozenblit, Ims, and Olgaard to include specifying that the transmitter include a module for generating uncertainty parameters including a status variable, as taught by Henry, because, as suggested by Henry, the

combination would have allowed the user of the sensors to obtain an accuracy measurement of the sensor data since sensors do not perfectly represent the value of a process variable obtained, and often includes effects, such as faults or distortion, resulting from the sensor itself (column 1, lines 20-26). Also, the invention of Henry teaches providing uncertainty and reliability of the best estimate as well as information about the operational status of the sensor (column 2, lines 17-20). Since the accuracy (i.e. reliability) and the operational status of the sensor of Thompson, Rozenblit, Olgaard, and Ims is dependent on the locking frequencies, as well as the locking conditions of the PLLs, one having ordinary skill in the art would recognize that the combination of Thompson, Rozenblit, Olgaard, and Ims with the teachings of Henry would have provided a self-validating module operable to generate validated uncertainty parameters based on the lock indicator signal and/or change in the lock frequency.

Further, with respect to claim 26, since the measurements of uncertainly would only be sought-after when the PLL's are in their desired operation, it would have been obvious to one having ordinary skill in the art to specify generating the uncertainty parameters only when the respective PLL's are locked, as indicated by the lock signals.

With respect to claim 30 and 32, as noted above, the invention of Thompson, Rozenblit, Ims and Olgaard teaches receiving an input signal from a vortex sensor and producing an output signal estimating the flow of fluid in a passage, and since it is considered to be well-known in the art that a vortex sensor produces an output

based on pressure variations due to vortex shedding (See U.S. Patent No. 5,576,497 to Vignos et al., column 2, lines 44-49, U.S. Patent No. 5,493,915 to Lew et al. column 9, lines 14-20), the combination meets these limitations as claimed.

10. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thompson in view of Rozenblit, Ims, and Olgaard and further in view of U.S. Patent No. 5,128,625 to Yatsuzuka et al.

As noted above, Thompson in combination with Rozenblit, Ims, and Olgaard teaches all the features of the claimed invention except for providing the output signal of the first PLL to the second PLL as a center frequency of the second PLL.

Yatsuzuka teaches an adaptive phase lock loop system comprising two phase locked loops prepared so that the first PLL caries out on the initial training mode, and the second PLL performs the conventional process so that when the PLLs are initially or periodically initiated, the second PLL is activated with the initial phase and center frequency given by the first PLL after the initial training mode is performed (column 14, lines 14-20).

It would have been obvious to one having ordinary skill in the art to modify the invention of Thompson, Rozenblit, Ims, and Olgaard to provide the output signal of the first PLL to the second PLL as a center frequency of the second PLL, as taught by Yatsuzuka, because, as suggested by Yatsuzuka, the combination would have provided fast accurate results and lock-in by training to obtain optimal values for the

corresponding input signal, thereby insuring that when the second PLL is initiated an optimum center frequency is used (abstract).

11. Claim 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thompson in view of Rozenblit, Ims, and further in view of U.S. Patent No. 5,128,625 to Yatsuzuka et al.

As noted above, Thompson in combination with Rozenblit and Ims teaches all the features of the claimed invention except for providing the output signal of the first PLL to the second PLL as a center frequency of the second PLL.

Yatsuzuka teaches an adaptive phase lock loop system comprising two phase locked loops prepared so that the first PLL caries out on the initial training mode, and the second PLL performs the conventional process so that when the PLLs are initially or periodically initiated, the second PLL is activated with the initial phase and center frequency given by the first PLL after the initial training mode is performed (column 14, lines 14-20).

It would have been obvious to one having ordinary skill in the art to modify the invention of Thompson, Rozenblit, and Ims to provide the output signal of the first PLL to the second PLL as a center frequency of the second PLL, as taught by Yatsuzuka, because, as suggested by Yatsuzuka, the combination would have provided fast accurate results and lock-in by training to obtain optimal values for the corresponding input signal, thereby insuring that when the second PLL is initiated an optimum center frequency is used (abstract).

Claim Objections

12. Claims 9 and 31 is objected to as being depended on a rejected claim but would be allowable over the cited prior art if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 9 is considered to be allowable over the cited prior art because while the cited prior art does teach a switchable pre-filter with cut-off frequencies the cited prior art does not indicate that this switchable pre-filter replaces the inputs to a PLL when it is on. Therefore, none of the cited prior art teaches or suggests, in combination with the other claimed limitations for a process variable transmitter, a pre-filter wherein, based on a status of the low-flow signal, a fixed center frequency of the second phase-locked loop switchable between an output signal of a first phase-locked loop, and $2\pi f_{ph}$, where f_{ph} is a high cut-off frequency of the pre-filter.

Claim 31 is considered to be allowable over the cited prior art because while the cited prior art does teach a self-validating module that includes status variables of CLEAR, BLURRED, DAZZLED, and BLIND, none of the cited prior art teaches or suggests, in combination with the other claimed limitations for a signal processing apparatus, specifying that the measurement status variable of the self-validating module be CLEAR when both lock indicator signals indicate lock, BLURRED when one of the two lock indicator signals indicates lock and the other of the two lock indicator signals indicates no lock, DAZZLED when both lock indicator signals

indicate no lock, and BLIND when both lock indicator signals indicate no lock for at least a predetermined length of time.

Response to Arguments

13. Applicant's arguments with respect to claims 1-27 have been considered but are moot in view of the new ground(s) of rejection.

The following argument, however, is hereby noted.

Applicant argues that "Henry et al. do not describe or suggest that a self-validating sensor could use a lock indicator from a phase-locked loop, much less describe or suggest how such a use would be implemented." The Examiner maintains that the limitations, as claimed, only require that the self-validating module be operable to generate validating uncertainty parameters based on the first lock indicator signal, and/or change of the lock frequency, and do not provide specifics as to how this process would be implemented. The process as described in the specification is not read into the claims (Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993)).

With respect to the combination, the invention of Thompson, Rozenblit, Olgaard and Ims teaches a sensing apparatus including a vortex sensor and dual phase locked loops with corresponding frequency locks. Henry then teaches self-validation that provides a best estimate of the value of a parameter being monitored based on all information available to the sensor (column 2, lines 10-14), which would include

the frequency lock information of the PLLs in Thompson, Rozenblit, Olgaard, and Ims.

Further, the invention of Henry teaches providing uncertainty and reliability of the best estimate as well as information about the operational status of the sensor (column 2, lines 17-20). Since the accuracy (i.e. reliability) and the operational status of the sensor of Thompson, Rozenblit, Olgaard, and Ims is dependent on the locking frequencies, as well as the locking conditions of the PLLs, one having ordinary skill in the art would recognize that the combination of Thompson, Rozenblit, Olgaard, and Ims with the teachings of Henry would have provided a self-validating module operable to generate validated uncertainty parameters based on the lock indicator signal and/or change in the lock frequency.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

U.S. Patent No. 5,493,915 to Lew et al. teaches a fluid dynamic torsional vortex sensor.

U.S. Patent No. 6,215,834 to McCollough teaches a dual bandwidth phase locked loop frequency lock detection system and method.

U.S. Patent No. 4,809,558 to Watson et al. teaches a method and apparatus for use with vortex flowmeters including low flow indications

U.S. Patent No. 6,408,011 to Nakatsugawa teaches a communication method between devices having different sampling rates including two phase locked loops receiving the same input and having selectable outputs.

U.S. Patent No. 3,593,138 to Dunn teaches a satellite interlace synchronization system including two phase locked loops and an indicator for indicating when both loops are locked.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey R. West whose telephone number is (703)308-1309. The examiner can normally be reached on Monday through Friday, 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marc S. Hoff can be reached on (703)308-1677. The fax phone numbers for the organization where this application or proceeding is assigned are (703)308-7382 for regular communications and (703)308-7382 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

jrw
September 30, 2003

Marc Hoff

MARC S. HOFF
SUPERVISORY PATENT EXAMINER
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